RIKEN QUANTUM COMPUTING

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2nd RQC Colloquium

Silicon-based quantum computing: The path from the laboratory to industrial manufacture

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May 18, 2022(Wed) **16:00–17:00**(JST)

This colloquium will be held **ONLINE**.

Registration: https://forms.gle/bpG2etS1Qkyn796H9

In this talk I will give an overview of the development of silicon-based quantum computing (QC), from the basic science through to its prospects for industrial-scale commercialization based on CMOS manufacturing. I begin with Kane's original proposal [1] for a silicon quantum computer, conceived at UNSW in 1998, based on single donor atoms in silicon, and will review the first demonstrations of such qubits, using both electron spins [2,3] and nuclear spins [4]. I then discuss the development of SiMOS quantum dot qubits, including the demonstration of single-electron occupancy [5], high-fidelity single-qubit gates [6], and the first demonstration of a two-qubit logic gate in silicon [7], together with assessments of silicon qubit fidelities [8,9]. I will also explore the technical issues related to scaling a silicon-CMOS based quantum processor [10] up to the millions of qubits that will be required for fault-tolerant QC, including the recent demonstration of silicon qubit operation above one kelvin [11].

References

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[5] C.H. Yang *et al.*, Nature Commun. **4**, 2069 (2013).
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[7] M. Veldhorst *et al.*, Nature **526**, 410 (2015).
[8] H. Yang *et al.*, Nature Electron. **2**, 151 (2019).
[9] W. Huang *et al.*, Nature **569**, 532 (2019).
[10] M. Veldhorst *et al.*, Nature Commun. **8**, 1766 (2017).
[11] H. Yang *et al.*, Nature **580**, 350 (2020).